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Robert Donley, Executive Director

January 14, 2015

Glen Dickinson, Director
Legislative Services Agency
State Capitol

Re: CHEEC Annual Report

Dear Mr. Dickinson:

The Center for Health Effects of Environmental Contamination was established at the University of Iowa with the passage of House File 631 by the 72nd General Assembly.

In accordance with Iowa Code §263.17 (4b), this annual report for the Center for Health Effects of Environmental Contamination is hereby submitted to the Legislative Council of the General Assembly.

If there are any questions concerning this report, please don't hesitate to contact this office.

Sincerely,

Robert Donley

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Attachment
cc: Legislative Liaisons
Legislative Log

Annual Report to the Iowa Legislature
For 2014

Submitted by:
The Center for Health Effects of Environmental Contamination
At
The University of Iowa

December, 2014

Background The Center for Health Effects of Environmental Contamination (CHEEC) at The University of Iowa (UI) is submitting this progress report for 2014 to the Iowa General Assembly in accordance with requirements outlined in the 1987 Iowa Groundwater Protection Act. Mandated within the Act was the establishment of CHEEC, whose mission is "*to determine the levels of environmental contamination which can be specifically associated with human health effects.*" Center activities include 1) developing and maintaining environmental databases to be used in conducting health effects research, 2) cooperating and collaborating on environmental health research programs and projects, 3) managing a seed grant program to support environmental health research, 4) providing education and service programs to the citizens of the state and the region, and 5) serving on state and local committees to provide environmental health expertise.

CHEEC is comprised of faculty from the UI Departments of Civil and Environmental Engineering, Epidemiology, Occupational and Environmental Health, Chemistry, and the State Hygienic Laboratory. Participating areas include the State Hygienic Laboratory, the UI Institute for Rural and Environmental Health, the Iowa Cancer Registry and the Iowa Registry for Congenital and Inherited Disorders. CHEEC works cooperatively with the Iowa Departments of Natural Resources (IDNR), Public Health (IDPH), and Agriculture and Land Stewardship (IDALS).

Advisory Committee The CHEEC Advisory Committee met on November 12, 2014. The final FY 2014 budget was discussed and the proposed FY 2015 budget was presented to the Committee and approved unanimously. Kristen Coleman (Department of Occupational and Environmental Health, UI College of Public Health) presented an overview of the CHEEC-funded seed grant project "*Establishing a Methodology for the Detection of Silica Particles in Lung Cancer Tissue Using Computer-Controlled Scanning Electron Microscopy.*"

Budget for Fiscal Year 2014 CHEEC receives 9% of the annual receipts in the Agricultural Management Account of the Iowa Groundwater Protection Fund. CHEEC's allocation from this Account totaled \$446,764 in FY 2014. Additionally, CHEEC generates revenue through federal grants and contracts, and private contracts that support CHEEC research activities. The personnel budget is presented in the categories of administration, data management, education programs, research programs, and service activities, to reflect effort in these areas. General operating costs within each area are presented separately for expenses charged to the General Account (Agricultural Management Account funds). Remaining expenses (portion of staff salaries) are covered by federal grants and contracts.

FY 2014 operating budget:

Revenue

Agricultural Management Account	\$446,764
Carry over from FY 2013	<u>\$ 39,213</u>
Total revenue	\$485,977

Expenditures

Personnel

(Salary + Fringe)

(1.70 FTE + Faculty director support + HR support – central Admin)

Administration	\$ 61,516
Data Management	\$ 49,213
Education	\$ 36,910
Research	\$ 86,123
Service	<u>\$ 12,303</u>
Total	\$ 246,065

Administration

Travel	\$ 1,685
General Supplies/misc	\$ 317
Telecommunications/postage	<u>\$ 46</u>
Total	\$ 2,048

Data Management Center

Hardware, Software, licenses, maintenance	\$ 2,933
Total	\$ 2,933

Education Programs

Seminars/Conference Exp.	\$5,000
Education grants	<u>\$1,500</u>
Total	\$ 6,500

Research Programs

Seed Grants	\$119,969
Cooperative Grant	<u>\$ 25,000</u>
Total	\$144,969

Total Expenditures **\$402,515**

Balance general account FY 2014 **\$83,462**

Carryover to FY 2014 (\$83,462) will be used to fund one additional seed grant (\$30,000) and two cooperative research grants @ \$25,000 each.

CHEEC Data Management Center During 2014, CHEEC staff provided support for database design and administration, and applications development for in-house, state, and federally-funded environmental health research projects. Environmental databases are designed and managed on the Oracle database management system.

CHEEC created and maintains computerized databases on Iowa water quality, including the *Iowa Historical Municipal Water Treatment and Supply Database*, the *Municipal Analytical Water Quality Database*, and the *Statewide Rural Well Water Survey (SWRL)*. Federal Safe Drinking Water Act data through 2013 were added for all municipal supplies to the *Municipal Analytical Water Quality Database*. In 2014, research efforts utilizing CHEEC's environmental health and computer database and research staff expertise included:

Exposure Assessment Method for Disinfection Byproducts in Drinking Water in the National Birth Defects Prevention Study (ongoing project)

Collaborators: National Birth Defects Prevention Study centers, U.S. EPA, CHEEC

Funding Agency: National Center on Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention (CDC)

This project calculated disinfection byproducts (DBP) exposures in public drinking water systems for participants in the National Birth Defects Prevention Study (NBDPS). The exposure assessment includes linking geocoded maternal addresses to appropriate drinking water utilities, linking relevant DBP water quality data to those residences, and modeling the DBP data to account for possible spatial and temporal variability. In 2014, CHEEC and the Iowa Registry for Congenital and Inherited Disorders began analyses on risk for cleft lip and palate defects in the NBDPS. Other NBDPS Centers are conducting analyses on other birth defect outcomes using individual exposure levels to DBPs from the CHEEC-led exposure assessment project.

Obtaining Water Quality Data for Public Water Supplies and Private Wells for the Agricultural Health Study (ongoing project)

Collaborators: CHEEC, State Hygienic Laboratory

Funding Agency: National Cancer Institute

This project is providing nitrate, pesticide and other water quality data for private wells and public water utilities across Iowa to use in modeling drinking water exposures for participants in the Agricultural Health Study (~ 89,000 persons enrolled in Iowa and North Carolina); the goal is to investigate the effects of environmental, occupational, dietary, and genetic factors on the health of the agricultural population. The data generated in this project will also be linked to the Iowa Women's Health Study (IWHS) cohort (~28,000 Iowa women enrolled in 1986), so that estimated exposures to pesticides and other contaminants in public water supplies, and nitrate and pesticides in private drinking water well users in the IWHS can be evaluated for cancer risk, and other adverse health outcomes.

Exposure Assessment for Drinking Water Contaminants and Cancer Risk in the Iowa Women's Health Study (ongoing project)

Collaborators: University of Minnesota, National Cancer Institute, CHEEC

Funding Agency: National Cancer Institute

This project will determine associations between environmental exposures and cancer incidence and mortality among older Iowa women by linking drinking water contaminant data

including nitrate, DBPs, and pesticides to the women's drinking water source to evaluate risk of brain, bladder, kidney, ovarian, thyroid and gastrointestinal cancers. This is a follow-up investigation to work which began in 1996 on the IWHS cohort, specifically looking at nitrate. Preliminary work will also begin on assessing arsenic drinking water concentrations in communities where IWHS participants resided.

Service/Education Activities CHEEC staff participate in environmental health service and education activities through committee membership, organizing and funding educational programs, and answering environmental health questions from the public through the CHEEC website or referrals from public and environmental health agencies. In March, 2014, CHEEC hosted and co-sponsored (with the Iowa Groundwater Association) the *Iowa Groundwater and Public Health Symposium* in Des Moines. CHEEC staff gave presentations on CHEEC research projects at the Iowa Association of Water Agencies Fall meeting, and at the Iowa Rural Water Association fall meetings. CHEEC staff served on the IDPH Advisory Committee for the Environmental Public Health Tracking Program, and on the State Hygienic Laboratory Board of External Advisors. During 2014, CHEEC responded to information requests from state and county health departments, the National Cancer Institute, university researchers and students, water treatment plant operators, the media, environmental activist groups, and the public.

Research Funding CHEEC administers a Seed Grant Program that supports pilot level research across a range of environmental research topics. Seed grant projects are small-scale studies designed to test new and unusual hypotheses, develop innovative methodologies in laboratory and field settings, or perform initial statistical analyses to support efforts to acquire federal or private grants for larger studies. The funding provides graduate level research opportunities, which strengthens graduate level programs, creates innovative research, and fosters interdisciplinary development of research opportunities.

CHEEC awards about one-third of its annual Agricultural Management Account allocation in seed funding. Since 1989, this investment has generated over ten dollars in external funding for every dollar invested by the program; seed grants projects have attracted over twenty million dollars in external funding for additional research. Seed grant funding provides hands-on learning opportunities for undergraduate and graduate students, enhancing their educational experience and preparing them for their professional lives. To date, over forty graduate degrees have resulted from seed grant projects, and over ninety articles describing seed grant projects have been published in peer-reviewed journals.

In fiscal year 2014, CHEEC awarded the following seed grants:

Simple and fast detection of pathogens in recreational waters

Investigators: R. Cademartiri, Department of Chemical and Biological Engineering, Iowa State University; M. Soupir, Department of Agricultural and Biosystems Engineering, Iowa State University

Executive Summary: Harmful microorganisms are the leading cause of water quality impairments in the United States, and are thought to be responsible for 900,000 illnesses and 900 deaths per year. Quick and accurate detection techniques are badly needed to better identify waters posing a risk to human health. The objective of this study is to generate preliminary data in three important areas for the development of a paper-based test for the detection of

pathogens in recreational waters: 1) the stability of bacteriophages on paper, 2) the pre-concentration of bacteria in water samples, and 3) the development of a sensitive colorimetric assay for bacteria on paper. The development of a paper-based device for detection of water-borne pathogens will provide information on the presence of pathogens in recreational waters at low-cost in a short period of time and can be used by volunteer groups, beach managers, and other public health officials.

Toxicity of organophosphate and carbamate pesticides for neuronal and non-neuronal cells

Investigator: J. Doorn, Department of Pharmaceutical Sciences and Experimental Therapeutics, The University of Iowa

Executive Summary: Organophosphate (OP) and carbamate pesticides are widely used in agriculture. Acute exposure to high doses may cause cholinergic toxicity; however, recent work demonstrates that exposure to low levels causes adverse effects in humans from neurological deficits to oxidative stress/reactive oxygen species (ROS). The mechanism for this “non-canonical” toxicity is unknown but concerning given the ubiquitous nature of OP and carbamates in the environment and significant human exposure. Such adverse consequences are likely due to effects of these pesticides on cell types found in the brain other than cholinergic neurons, such as other neurons or glial cells (non-neuronal). The goal of this project is to determine which neuron types (i.e., cholinergic, glutamatergic, dopaminergic) or non-neuronal cells (i.e., astrocyte) are most sensitive to OP and carbamate pesticides, yielding toxicity and/or oxidative stress/ROS. In addition, the investigator seeks to identify the insulting species of the OP agent, i.e., phosphorothioate or bioactive oxon metabolite.

Estimating prenatal exposure to lead in Iowa newborns

Investigators: A. Saftlas, K. Ryckman, Department of Epidemiology, The University of Iowa

Executive Summary: Lead is a highly potent human toxicant that readily crosses the placenta of the developing fetus and impairs the development and function of multiple organ systems. Developing effective methods for measuring prenatal lead exposure and identifying women at risk for high lead levels in pregnancy is an essential public health priority. This pilot project will: 1) estimate the correlation of lead concentrations measured from 50 paired newborn dried blood spot and fetal cord blood samples; and 2) identify geographical “hot spots” for prenatal lead exposure in Iowa based on a consecutive sample of 1,866 Iowa newborns with lead concentrations measured from newborn blood spot cards. These pilot data will be used to design a larger investigation with the objectives of establishing baseline levels of lead exposure in newborns and identifying high-risk subgroups for intervention.

Naturally-occurring radioactivity liberated by new natural gas mining technologies: A pilot study of the geochemical partitioning and potential for radionuclide migration and exposure to higher organisms and humans

Investigators: M. Schultz, Departments of Radiology and Radiation Oncology, The University of Iowa; T. Forbes, Department of Chemistry, The University of Iowa

Executive Summary: New drilling and hydraulic-fracturing technologies have unlocked economically-lucrative reserves of natural gas and the practice is proliferating rapidly. However, solid and liquid waste from these activities is enriched in naturally-occurring radioactive materials (NORM). Further, sediments downstream from wastewater treatment facilities are enriched in NORM. Similarly, NORM levels in solid waste are too high for

disposal in many municipal facilities and are often buried on home sites. This pilot study will collect and analyze surface water, sediments, and plants at a wastewater treatment site in West Virginia that accepts hydraulic-fracturing wastewater, and will also collect and determine the leachability of NORM from solid-waste.

Cooperative Research Grant

CHEEC initiated a cooperative research program in 1999, which seeks to leverage research monies from university, state, and federal entities to conduct research in areas of mutual interest with collaborators. The collaboration requires matching funds from participating entities. A member of CHEEC's executive committee must serve as a co-investigator. Like the Seed Grant Program, it seeks to establish innovative lines of environmental health research leading to preliminary results that may be used in seeking further larger grant funding from federal and private sources. In FY 2014, CHEEC awarded one Cooperative Research Grant:

Development of novel, composite nanomaterials for water filtration

Investigators: S. Larsen, UI Department of Chemistry; D. Cwiertny, G. Parkin, UI Department of Civil and Environmental Engineering

Cooperators: Savannah River National Laboratory; U.S. Environmental Protection Agency

Executive Summary: Approximately 1/3 of the world's population lacks access to safe drinking water. Human exposures to drinking water contaminants, such as arsenic, have been linked to cancer, neurological, cardiovascular and pulmonary health problems. In a recent survey of private wells in Iowa, 48% were found to contain arsenic and 8% were determined to have arsenic levels greater than the EPA's drinking water standard of 10 ppb. It is critical, both globally and locally, to develop improved methods for removing groundwater contaminants. Investigators in this study will design, fabricate and evaluate mesoporous silica-coated electrospun iron oxide nanofibers for arsenic adsorption from water. The Larsen Lab is developing functionalized mesoporous silica materials for adsorption of radioactive contaminants; these materials are also promising for application as arsenic adsorbents. The Cwiertny/Parkin Lab is developing electrospun nanofibers for use as chemically active filtration materials. CHEEC funds will allow the two Labs to work collaboratively to develop and evaluate these novel composite adsorbents.